actuator. Other embodiments of the present invention may use different signals to drive and brake a resonant actuator. For example, signal **602** maintains its full amplitude after being inverted **603** and is applied to the actuator for a duration required to bring the actuator to rest. In other embodiments of the present invention, other signals may be used. For example, in one embodiment of the present invention, the signal driving the resonant actuator may be inverted and the inverted signal may have a lower amplitude than the signal used to drive the actuator. In another embodiment, the inverted signal may not be transmitted to the resonant actuator for a duration required to bring the actuator to rest. For example, the inverted signal may be transmitted to the resonant actuator for a duration required to conform the motion of the resonant actuator to a haptic envelope. In still a further embodiment, the inverted signal may be have a greater amplitude than the non-inverted signal.

General

[**0088**] The foregoing description of the embodiments, including preferred embodiments, of the invention has been presented only for the purpose of illustration and description and is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Numerous modifications and adaptations thereof will be apparent to those skilled in the art without departing from the spirit and scope of the this invention.

That which is claimed is:

1. A method for braking an actuator comprising:

generating a first actuator signal having a frequency approximately resonant to the actuator, the first actuator signal configured to drive the actuator;

transmitting the first actuator signal to the actuator;

generating a second actuator signal having approximately the frequency of the first actuator signal and a phase approximately 180 degrees out of phase to the first actuator signal, the second actuator signal configured to cause a braking force on the actuator; and

transmitting the second actuator signal to the actuator.

2. The method of claim 1, wherein the first actuator signal is configured to cause the actuator to generate a vibrotactile haptic effect.

3. The method of claim 1, further comprising generating a vibrotactile haptic effect envelope before generating the first actuator signal, wherein the first actuator signal comprises a modulated amplitude based at least in part on the vibrotactile haptic effect envelope, and the second actuator signal comprises an amplitude based at least in part on the vibrotactile haptic effect envelope.

4. The method of claim 3, wherein the vibrotactile haptic effect envelope comprises a substantially periodic signal having a frequency lower than the first and second actuator signals.

5. The method of claim 1, further comprising generating a vibrotactile haptic effect envelope before generating the first actuator signal, wherein the first actuator signal comprises a modulated amplitude based at least in part on the vibrotactile haptic effect envelope, and the second actuator signal comprises a duration based at least in part on the vibrotactile haptic effect envelope.

6. The method of claim 5, wherein the second actuator signal comprises a maximum magnitude.

7. The method of claim 1, further comprising:

generating a modulating signal configured to modulate the amplitude of the first and second actuator signals; and

combining the first and second actuator signals with the modulating signal such that the amplitude of the first and second actuator signals is changed based at least in part on the modulating signal.

8. The method of claim 1, wherein generating the first actuator signal comprises:

generating a first rectangular wave having a frequency approximately resonant to the actuator,

generating a second rectangular wave having approximately the same frequency by logically exclusive-ORing the first rectangular wave with a digital signal in a first logic state; and

generating the second actuator signal comprises:

changing the digital signal to a second logic state,

generating a third rectangular wave having approximately the frequency of the first actuator signal and a phase approximately 180 degrees out of phase to the first actuator signal by logically exclusive-ORing the first rectangular wave with the digital signal in a second logic state.

9. The method of claim 8, wherein generating the first actuator signal further comprises transmitting the second rectangular wave through a filter configured to generate a substantially sinusoidal wave at approximately the same frequency as the second rectangular wave; and

generating the second actuator signal further comprises transmitting the third rectangular wave through the filter.

10. The method of claim 1, wherein the first and second actuator signals, each comprises a substantially sinusoidal wave.

11. A system for braking an actuator comprising:

an actuator; and

a signal generator in communication with the actuator, the signal generator configured to:

generate a first actuator signal having a frequency approximately resonant to the actuator, the first actuator signal configured to drive the actuator,

transmit the first actuator signal to the actuator,

generate a second actuator signal having approximately the frequency of the first actuator signal and a phase approximately 180 degrees out of phase to the first actuator signal, the second actuator signal configured to cause a braking force on the actuator, and

transmit the second actuator signal to the actuator.

12. The system of claim 11, wherein the first actuator signal is configured to generate a vibrotactile haptic effect.

13. The system of claim 11, wherein the signal generator is further configured to:

receive a vibrotactile haptic effect envelope;